

STREAM INVENTORY REPORT

“Nelson Gulch”

INTRODUCTION

A stream inventory was conducted on May 14 and May 15, 2012 on an unnamed tributary to Big River commonly known as, and herein after referred to as, Nelson Gulch. The survey began at the confluence with Big River and extended upstream 0.5 miles.

The Nelson Gulch inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Nelson Gulch. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species.

The objective of this report is to document the current habitat conditions and recommend options for the potential enhancement of habitat for coho salmon and steelhead trout. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Nelson Gulch is a tributary to Big River, which drains to the Pacific Ocean. It is located in Mendocino County, California (Map 1). Nelson Gulch's legal description at the confluence with Big River is T17N R17W S26. Its location is 39.2991 degrees north latitude and 123.7330 degrees west longitude, LLID number 1237318392991. Nelson Gulch is a first order stream and has approximately 0.3 miles of blue line stream according to the USGS Mathison Peak 7.5 minute quadrangle. Nelson Gulch drains a watershed of approximately 0.7 square miles. Elevations range from about 10 feet at the mouth of the creek to 500 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily California State Parks land and is managed for recreation. Vehicle access exists via Mendocino Headlands State Park.

METHODS

The habitat inventory conducted in Nelson Gulch follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Department of Fish and Wildlife (CDFW) personnel that conducted the inventory were trained in standardized habitat inventory methods by the CDFW. This inventory was conducted by a two-person team.

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are measured for maximum depth, depth of pool tail

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crest (measured in the thalweg), dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement.

HABITAT INVENTORY COMPONENTS

A standardized habitat inventory form has been developed for use in California stream surveys and can be found in the *California Salmonid Stream Habitat Restoration Manual*. This form was used in Nelson Gulch to record measurements and observations. There are eleven components to the inventory form.

1. Flow:

Flow is measured in cubic feet per second (cfs) near the bottom of the stream survey reach using a Marsh-McBirney Model 2000 flow meter.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1994). This methodology is described in the *California Salmonid Stream Habitat Restoration Manual*. Channel typing is conducted simultaneously with habitat typing and follows a standard form to record measurements and observations. There are five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 4) substrate composition, and 5) sinuosity. Channel characteristics are measured using a clinometer, hand level, hip chain, tape measure, and a stadia rod.

3. Temperatures:

Both water and air temperatures are measured and recorded at every tenth habitat unit. The time of the measurement is also recorded. Both temperatures are taken in degrees Fahrenheit at the middle of the habitat unit and within one foot of the water surface.

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1990). Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled "dry". Nelson Gulch habitat typing used standard basin level measurement criteria. These parameters require that the minimum length of a described habitat unit must be equal to or greater than the stream's mean wetted width. All measurements are in feet to the nearest tenth. Habitat characteristics are measured using a clinometer, hip chain, and stadia rod.

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5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Nelson Gulch, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed not suitable for spawning due to inappropriate substrate like bedrock, log sills, boulders or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide juvenile salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition for prey. The shelter rating is calculated for each fully-described habitat unit by multiplying shelter value and percent cover. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is then classified according to a list of nine cover types. In Nelson Gulch, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. Thus, shelter ratings can range from 0-300 and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

Substrate composition ranges from silt/clay sized particles to boulders and bedrock elements. In all fully-described habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes and recorded as a one and two, respectively. In addition, the dominant substrate composing the pool tail-outs is recorded for each pool.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Nelson Gulch, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated ocularly into percentages of coniferous or hardwood trees.

9. Bank Composition and Vegetation:

Bank composition elements range from bedrock to bare soil. However, the stream banks are usually covered with grass, brush, or trees. These factors influence the ability of stream banks to withstand winter flows. In Nelson Gulch, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully-described unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation (including downed trees, logs, and rootwads) was estimated and recorded.

10. Large Woody Debris Count:

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Large woody debris (LWD) is an important component of fish habitat and an element in channel forming processes. In each habitat unit all pieces of LWD partially or entirely below the elevation of bankfull discharge are counted and recorded. The minimum size to be considered is twelve inches in diameter and six feet in length. The LWD count is presented by reach and is expressed as an average per 100 feet.

11. Average Bankfull Width:

Bankfull width can vary greatly in the course of a channel type stream reach. This is especially true in very long reaches. Bankfull width can be a factor in habitat components like canopy density, water temperature, and pool depths. Frequent measurements taken at riffle crests (velocity crossovers) are needed to accurately describe reach widths. At the first appropriate velocity crossover that occurs after the beginning of a new stream survey page (ten habitat units), bankfull width is measured and recorded in the appropriate header block of the page. These widths are presented as an average for the channel type reach.

BIOLOGICAL INVENTORY

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. Fish presence was observed from the stream banks in Nelson Gulch. In addition, 10 sites were electrofished using a Smith-Root Model LR-24 electrofisher. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.19, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission in conjunction with the California Department of Fish and Wildlife. This program processes and summarizes the data, and produces the following ten tables:

- Riffle, Flatwater, and Pool Habitat Types
- Habitat Types and Measured Parameters
- Pool Types
- Maximum Residual Pool Depths by Habitat Types
- Mean Percent Cover by Habitat Type
- Dominant Substrates by Habitat Type
- Mean Percent Vegetative Cover for Entire Stream
- Fish Habitat Inventory Data Summary by Stream Reach (Table 8)
- Mean Percent Dominant Substrate / Dominant Vegetation Type for Entire Stream
- Mean Percent Shelter Cover Types for Entire Stream

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Graphics are produced from the tables using Microsoft Excel. Graphics developed for Nelson Gulch include:

- Riffle, Flatwater, Pool Habitat Types by Percent Occurrence
- Riffle, Flatwater, Pool Habitat Types by Total Length
- Total Habitat Types by Percent Occurrence
- Pool Types by Percent Occurrence
- Maximum Residual Depth in Pools
- Percent Embeddedness
- Mean Percent Cover Types in Pools
- Substrate Composition in Pool Tail-outs
- Mean Percent Canopy
- Dominant Bank Composition by Composition Type
- Dominant Bank Vegetation by Vegetation Type

HABITAT INVENTORY RESULTS

* ALL TABLES AND GRAPHS ARE LOCATED AT THE END OF THE REPORT *

The habitat inventory of May 14 and May 15, 2012 was conducted by M. Groff and I. Mikus (CDFW). The total length of the stream surveyed was 2,805 feet with an additional 30 feet of side channel.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.56 cfs on May 17, 2012.

Nelson Gulch is an E4 channel type for 1,163 feet of the stream surveyed (Reach 1), and an A4 channel type for 1,642 feet of the stream surveyed (Reach 2). E4 channels are low gradient, meandering riffle/pool streams with low width/depth ratios and little deposition. They are very efficient and stable with a high meander width ratio and gravel-dominant substrates. A4 channels are steep, narrow, cascading, step-pool, high energy debris transporting channels associated with depositional soils, and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 51 to 52 degrees Fahrenheit. Air temperatures ranged from 56 to 66 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 37% pool units, 33% riffle units, 29% flatwater units, and 2% culvert units (Graph 1). Based on total length of Level II habitat types there were 41% flatwater units, 33% riffle units, 21% pool units, and 4% culvert units (Graph 2).

Ten Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 21%; high gradient riffle units, 20%; and step run units, 15% (Graph 3). Based on percent total length, step run units made up 31%, high gradient riffle units 21%, and low gradient riffle units 12%.

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A total of 50 pools were identified (Table 3). Main channel pools were the most frequently encountered at 60% (Graph 4), and comprised 60% of the total length of all pools (Table 3).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. One of the 50 pools (2%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 50 pool tail-outs measured, two had a value of 1 (4%); 16 had a value of 2 (32%); 19 had a value of 3 (38%); 12 had a value of 4 (24%); and one had a value of 5 (2%); (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed not suitable for spawning due to inappropriate substrate such as bedrock, log sills, boulders, or other considerations.

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Riffle habitat types had a mean shelter rating of 0, flatwater habitat types had a mean shelter rating of 2, and pool habitats had a mean shelter rating of 12 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 13. Scour pools had a mean shelter rating of 11 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Undercut banks are the dominant cover type in Nelson Gulch. Graph 7 describes the pool cover in Nelson Gulch. Undercut banks are the dominant pool cover type, followed by large woody debris.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel was the dominant substrate observed in 78% of the pool tail-outs. Sand was the next most frequently observed dominant substrate type and occurred in 20% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Nelson Gulch was 98%. Two percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 38% and 62%, respectively. Graph 9 describes the mean percent canopy in Nelson Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 100%. The mean percent left bank vegetated was 100%. The dominant elements composing the structure of the stream banks consisted of 98% sand/silt/clay, and 2% cobble/gravel (Graph 10). Coniferous trees were the dominant vegetation type observed in 50% of the units surveyed. Additionally, 34% of the units surveyed had brush as the dominant vegetation type, and 16% had deciduous trees as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Survey teams conducted an electrofishing survey at 10 sites for species composition and distribution in Nelson Gulch on June 19, 2012. The water temperature taken during the

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electrofishing period of 1225 hours to 1315 hours was 56 degrees Fahrenheit. The air temperature was 70 degrees Fahrenheit. The sites were sampled by S. Monday, M. Groff, and I. Mikus (CDFW).

In Reach 1, which comprised the first 1,163 feet of stream, 10 sites were sampled. The reach sites yielded three age 1+ steelhead/rainbow trout (SH/RT) and six sculpin.

The following chart displays the information yielded from these sites:

2012 Nelson Gulch electrofishing observations.

Date	Survey Site #	Habitat Unit #	Habitat Type	Approx. Dist. from mouth (ft.)	SH/RT			Coho	
					YOY	1+	2+	YOY	1+
Reach 1: E4 Channel Type									
06/19/12	1	005	Run	226	0	1	0	0	0
	2	006	Pool	241	0	0	0	0	0
	3	007	Pool	260	0	0	0	0	0
	4	012	Pool	346	0	1	0	0	0
	5	013	Pool	371	0	0	0	0	0
	6	016	Run	406	0	0	0	0	0
	7	018	Pool	433	0	0	0	0	0
	8	022	Run	493	0	0	0	0	0
	9	024	Run	546	0	0	0	0	0
	10	025	Pool	558	0	1	0	0	0

DISCUSSION

Nelson Gulch is an E4 channel type for the first 1,163 feet of stream surveyed, and an A4 channel type for the remaining 1,642 feet. The suitability of E4 and A4 channel types for fish habitat improvement structures is as follows: E4 channel types are good for bank-placed boulders and fair for opposing wing-deflectors. A4 channels are generally not suitable for fish habitat improvement projects.

The water temperatures recorded on the survey days May 14 and May 15, 2012 ranged from 51 to 52 degrees Fahrenheit. Air temperatures ranged from 56 to 66 degrees Fahrenheit. This is a suitable water temperature range for salmonids. To make any further conclusions, temperatures need to be monitored throughout the warm summer months, and more extensive biological sampling needs to be conducted.

Flatwater habitat types comprised 41% of the total length of this survey, riffles 33%, and pools 21%. One of the 50 (2%) pools had a maximum residual depth greater than two feet. In general,

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pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In first and second order streams, a primary pool is defined to have a maximum residual depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. In Reach 1, installing large wood structures that will increase or deepen pool habitat is recommended.

Eighteen of the 50 pool tail-outs measured had embeddedness ratings of 1 or 2. Thirty-one of the pool tail-outs had embeddedness ratings of 3 or 4. One of the pool tail-outs had a rating of 5, which is considered not suitable for spawning. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. Sediment sources in Nelson Gulch should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Thirty-nine of the 50 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter rating for pools is 12. The shelter rating in the flatwater habitats is 2. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by undercut banks in Nelson Gulch. Undercut banks are the dominant cover type in pools followed by large woody debris. Log and root wad cover structures in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structures provide rearing fry with protection from predation, rest from water velocity, and also divide territorial units to reduce density related competition.

The mean percent canopy density for the stream was 98%. Reach 1 had a canopy density of 98%, Reach 2 had a canopy density of 98%. In general, revegetation projects are considered when canopy density is less than 80%. The percentage of right and left bank covered with vegetation was 100% and 100%, respectively.

RECOMMENDATIONS

- 1) Nelson Gulch should be managed as an anadromous, natural production stream.
- 2) The limited water temperature data available suggest that maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.
- 3) In Reach 1, increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from undercut banks. Adding high quality complexity with woody cover in the pools is desirable.
- 4) Active and potential sediment sources related to the road system need to be identified, mapped, and treated according to their potential for sediment yield to the stream and its tributaries.

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- 5) Due to the undersized culvert under the Road M1 and an undersized culvert at 2,107 feet, access for migrating salmonids is an ongoing problem. A fish passage assessment should be conducted at both sites. If the assessment finds the culverts to be barriers to fish passage they should be replaced with structures that provides unimpeded fish passage. Good water temperature and flow regimes exist in the stream and it offers good conditions for rearing fish.

COMMENTS AND LANDMARKS

The following landmarks and possible problem sites were noted. All distances are approximate and taken from the beginning of the survey reach.

Position (ft):	Habitat unit #:	Comments:
0	0001.00	Start of survey at the confluence with Big River. The channel is an E4.
41	0004.00	Road M1 crosses the channel. The crossing was originally a 4' high x 4' wide x 40' long corrugated metal culvert, but the outlet was crushed and now measures 3.2' high x 3' wide. The culvert is rusty, in some areas the bottom has completely rusted out, leaving large holes. There appears to be a debris build up within the culvert creating a plunge approximately 8' upstream from the outlet. The culvert is misaligned and there is large woody debris (LWD) potentially blocking the inlet. The culvert has a slope of 7%.
346	0013.00	There is a 0.9' high plunge over root mass.
462	0021.00	Salmonid young-of-the-year (YOY) observed.
730	0035.00	A large redwood rootwad and small woody debris (SWD) combine to create a 3' high plunge.
1163	0055.00	The channel changes from an E4 to an A4.
1188	0057.00	There is a 3' high plunge over a root mass.
1202	0057.03	There is a 2' high plunge over woody debris.
1281	0060.00	There is a 2' high plunge over a root mass.
1330	0063.00	There is a 0.5' high plunge over large woody debris.
1415	0069.00	There is a 2.5' high plunge over large woody debris.

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1540	0075.00	Tributary #01 enters on the right bank. It contributes approximately 40% to Nelson Gulch's flow. The water temperature of the tributary was 51 degrees Fahrenheit; the water temperature downstream and upstream of the tributary was 51 degrees Fahrenheit. The slope of the tributary is approximately 10%. The tributary is not accessible to salmonids.
1652	0081.00	The water is flowing under a 4' diameter redwood log lying in the channel. There is a 3' drop in elevation as the water flows under the log.
1691	0084.00	There is a 2' high plunge over woody debris.
1776	0090.00	There is a 2.5' high plunge over woody debris and root mass.
1891	0095.00	There is a 2' high plunge over large woody debris.
1907	0096.00	Dry tributary on the left bank.
1979	0098.00	There is a 2.5' high plunge over a boulder and woody debris.
2090	0105.00	There is a 0.7' high plunge from culvert.
2107	0106.00	An abandoned logging road crosses the channel. The crossing is a 3' high x 3' wide x 85' long corrugated metal culvert. The culvert has a slope of 10.1%. There is a 0.7' high plunge at the outlet; the maximum depth within 5' of the outlet is 1.7'. The culvert is rusty; in some areas the bottom has rusted out completely. The culvert is misaligned. The creek enters the culvert through the right side of the inlet where there is a hole in the side.
2198	0108.00	There is a 1.5' high plunge over small woody debris. Red-legged frog observed.
2299	0113.00	There is a 4.5' high plunge over a root mass, boulders and LWD.
2460	0125.00	Log debris accumulation (LDA) #01 contains five pieces of LWD and measures 4' high x 8' wide x 4' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to gravel and measures 8' wide x 40' long x 2' deep. It is a possible barrier to juvenile and adult salmonids due to the 3' high plunge over the LDA. No fish were observed above the LDA.
2752	0133.00	End of survey. The channel splits in two directions. The mainstem is smaller than the tributary; it holds approximately 30% of the total flow. The mainstem is narrow with a slope of approximately 8% for the first 300 feet. The flow decreases upstream; in some areas the water is not moving at all and the channel is almost dry. There are no pools. Approximately 300 feet upstream from the channel split, the slope

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increases to greater than 20%. The mainstem above the split is steep and has little flow. The right bank tributary has little habitat. Approximately 550 feet upstream from the confluence with the mainstem there is an LDA that is the probable end of anadromy. Only five pools were observed in the length below the LDA.

REFERENCES

Flosi, G., Downie, S., Hopelain, J., Bird, M., Coey, R., and Collins, B. 1998. *California Salmonid Stream Habitat Restoration Manual*, 3rd edition. California Department of Fish and Game, Sacramento, California.

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LEVEL III and LEVEL IV HABITAT TYPES

RIFFLE

Low Gradient Riffle	(LGR)	[1.1]	{ 1 }
High Gradient Riffle	(HGR)	[1.2]	{ 2 }

CASCADE

Cascade	(CAS)	[2.1]	{ 3 }
Bedrock Sheet	(BRS)	[2.2]	{24}

FLATWATER

Pocket Water	(POW)	[3.1]	{21}
Glide	(GLD)	[3.2]	{14}
Run	(RUN)	[3.3]	{15}
Step Run	(SRN)	[3.4]	{16}
Edgewater	(EDW)	[3.5]	{18}

MAIN CHANNEL POOLS

Trench Pool	(TRP)	[4.1]	{ 8 }
Mid-Channel Pool	(MCP)	[4.2]	{17}
Channel Confluence Pool	(CCP)	[4.3]	{19}
Step Pool	(STP)	[4.4]	{23}

SCOUR POOLS

Corner Pool	(CRP)	[5.1]	{22}
Lateral Scour Pool - Log Enhanced	(LSL)	[5.2]	{10}
Lateral Scour Pool - Root Wad Enhanced	(LSR)	[5.3]	{11}
Lateral Scour Pool - Bedrock Formed	(LSBk)	[5.4]	{12}
Lateral Scour Pool - Boulder Formed	(LSBo)	[5.5]	{20}
Plunge Pool	(PLP)	[5.6]	{ 9 }

BACKWATER POOLS

Secondary Channel Pool	(SCP)	[6.1]	{ 4 }
Backwater Pool - Boulder Formed	(BPB)	[6.2]	{ 5 }
Backwater Pool - Root Wad Formed	(BPR)	[6.3]	{ 6 }
Backwater Pool - Log Formed	(BPL)	[6.4]	{ 7 }
Dammed Pool	(DPL)	[6.5]	{13}

ADDITIONAL UNIT DESIGNATIONS

Dry	(DRY)	[7.0]	
Culvert	(CUL)	[8.0]	
Not Surveyed	(NS)	[9.0]	
Not Surveyed due to a marsh	(MAR)	[9.1]	

Table 1 - Summary of Riffle, Flatwater, and Pool Habitat Types

Stream Name: 1237318392991

LLID: 1237318392991 Drainage: Big River

Survey Dates: 5/14/2012 to 5/15/2012

Confluence Location: Quad: MATHISON PEAK Legal Description: T17NR17WS26 Latitude: 39:17:57.0N Longitude: 123:43:54.0

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Mean Max Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume (cu.ft.)	Mean Residual Pool Vol (cu.ft.)	Mean Shelter Rating
2	0	CULVERT	1.5	62	125	4.4									
39	10	FLATWATER	28.7	30	1173	41.4	4.1	0.4	0.8	92	3575	35	1380		2
50	50	POOL	36.8	12	607	21.4	6.6	0.6	1.3	77	3838	60	3021	46	12
45	6	RIFFLE	33.1	21	930	32.8	4.0	0.2	0.6	82	3686	20	885		0
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
136	66				2835					11099			5286		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: 1237318392991

LLID: 1237318392991

Drainage: Big River

Survey Dates: 5/14/2012 to 5/15/2012

Confluence Location: Quad: MATHISON PEAK

Legal Description: T17NR17WS26

Latitude: 39:17:57.0N

Longitude: 123:43:54.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Max Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume (cu.ft.)	Mean Residual Pool Vol (cu.ft.)	Mean Shelter Rating	Mean Canopy (%)
18	3	LGR	13.2	19	334	11.8	4	0.2	0.4	83	1489	17	298		0	99
27	3	HGR	19.9	22	596	21.0	4	0.3	1.5	81	2189	23	616		0	98
19	4	RUN	14.0	16	308	10.9	4	0.4	0.9	48	904	20	372		3	97
20	6	SRN	14.7	43	865	30.5	4	0.4	1.1	121	2421	46	918		1	98
28	28	MCP	20.6	11	317	11.2	7	0.6	1.7	73	2055	55	1543	41	13	98
1	1	CCP	0.7	14	14	0.5	6	0.6	1.4	84	84	67	67	50	5	99
1	1	STP	0.7	34	34	1.2	4	0.4	1.3	153	153	92	92	61	20	99
1	1	LSL	0.7	14	14	0.5	5	0.6	1.1	70	70	49	49	42	5	97
3	3	LSBk	2.2	14	42	1.5	4	0.3	1	60	180	29	87	17	5	100
16	16	PLP	11.8	12	186	6.6	7	0.7	3	81	1296	74	1184	59	13	99
2	0	CUL	1.5	62	125	4.4										

Total Units
136

Total Units Fully Measured
66

Total Length (ft.)
2835

Total Area (sq.ft.)
10842

Total Volume (cu.ft.)
5225

Table 3 - Summary of Pool Types

Stream Name: 1237318392991

LLID: 1237318392991

Drainage: Big River

Survey Dates: 5/14/2012 to 5/15/2012

Confluence Location: Quad: MATHISON PEAK

Legal Description: T17NR17WS26

Latitude: 39:17:57.0N

Longitude: 123:43:54.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Residual Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Residual Pool Vol (cu.ft.)	Estimated Total Resid. Vol. (cu.ft.)	Mean Shelter Rating
30	30	MAIN	60	12	365	60	6.6	0.6	76	2292	42	1251	13
20	20	SCOUR	40	12	242	40	6.5	0.6	77	1546	52	1043	11

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
50	50	607	3838	2294

Table 4 - Summary of Maximum Residual Pool Depths By Pool Habitat Types

Stream Name: 1237318392991

LLID: 1237318392991

Drainage: Big River

Survey Dates: 5/14/2012 to 5/15/2012

Confluence Location: Quad: MATHISON PEAK

Legal Description: T17NR17WS26

Latitude: 39:17:57.0N

Longitude: 123:43:54.0W

Habitat Units	Habitat Type	Habitat Occurrence (%)	< 1 Foot Maximum Residual Depth	< 1 Foot Percent Occurrence	1 < 2 Feet Maximum Residual Depth	1 < 2 Feet Percent Occurrence	2 < 3 Feet Maximum Residual Depth	2 < 3 Feet Percent Occurrence	3 < 4 Feet Maximum Residual Depth	3 < 4 Feet Percent Occurrence	>= 4 Feet Maximum Residual Depth	>= 4 Feet Percent Occurrence
28	MCP	56	6	21	22	79	0	0	0	0	0	0
1	CCP	2	0	0	1	100	0	0	0	0	0	0
1	STP	2	0	0	1	100	0	0	0	0	0	0
1	LSL	2	0	0	1	100	0	0	0	0	0	0
3	LSBk	6	2	67	1	33	0	0	0	0	0	0
16	PLP	32	2	13	13	81	0	0	1	6	0	0

Total Units	Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1< 2 Foot Max Resid. Depth	Total 1< 2 Foot % Occurrence	Total 2< 3 Foot Max Resid. Depth	Total 2< 3 Foot % Occurrence	Total 3< 4 Foot Max Resid. Depth	Total 3< 4 Foot % Occurrence	Total >= 4 Foot Max Resid. Depth	Total >= 4 Foot % Occurrence
50	10	20	39	78	0	0	1	2	0	0

Mean Maximum Residual Pool Depth (ft.): 1.3

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: 1237318392991

LLID: 1237318392991

Drainage: Big River

Survey Dates: 5/14/2012 to 5/15/2012

Dry Units: 0

Confluence Location: Quad: MATHISON PEAK

Legal Description: T17NR17WS26

Latitude: 39:17:57.0N

Longitude: 123:43:54.0W

Habitat Units	Units Fully Measured	Habitat Type	Mean % Undercut Banks	Mean % SWD	Mean % LWD	Mean % Root Mass	Mean % Terr. Vegetation	Mean % Aquatic Vegetation	Mean % White Water	Mean % Boulders	Mean % Bedrock Ledges
18	3	LGR	0	0	0	0	0	0	0	0	0
27	3	HGR	0	0	0	0	0	0	0	0	0
45	6	TOTAL RIFFLE	0	0	0	0	0	0	0	0	0
19	4	RUN	0	85	15	0	0	0	0	0	0
20	6	SRN	0	70	30	0	0	0	0	0	0
39	10	TOTAL FLAT	0	80	20	0	0	0	0	0	0
28	28	MCP	34	33	30	0	0	0	2	1	0
1	1	CCP	0	10	90	0	0	0	0	0	0
1	1	STP	55	15	15	0	0	0	15	0	0
1	1	LSL	0	0	100	0	0	0	0	0	0
3	3	LSBk	100	0	0	0	0	0	0	0	0
16	16	PLP	23	18	22	1	0	0	36	1	0
50	50	TOTAL POOL	32	25	28	1	0	0	13	1	0
2	0	CUL									
136	66	TOTAL	30	29	28	1	0	0	12	1	0

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: 1237318392991

LLID: 1237318392991

Drainage: Big River

Survey Dates: 5/14/2012 to 5/15/2012

Dry Units: 0

Confluence Location: Quad: MATHISON PEAK

Legal Description: T17NR17WS26

Latitude: 39:17:57.0N

Longitude: 123:43:54.0W

Habitat Units	Units Fully Measured	Habitat Type	% Total Silt/Clay Dominant	% Total Sand Dominant	% Total Gravel Dominant	% Total Small Cobble Dominant	% Total Large Cobble Dominant	% Total Boulder Dominant	% Total Bedrock Dominant
18	3	LGR	0	0	100	0	0	0	0
27	3	HGR	0	0	67	0	0	33	0
19	4	RUN	0	75	25	0	0	0	0
20	6	SRN	0	0	100	0	0	0	0
28	28	MCP	0	71	29	0	0	0	0
1	1	CCP	0	100	0	0	0	0	0
1	1	STP	0	100	0	0	0	0	0
1	1	LSL	0	0	100	0	0	0	0
3	3	LSBk	0	67	33	0	0	0	0
16	16	PLP	0	88	13	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: 1237318392991

LLID: 1237318392991

Drainage: Big River

Survey Dates: 5/14/2012 to 5/15/2012

Confluence Location: Quad: MATHISON PEAK

Legal Description: T17NR17WS26

Latitude: 39:17:57.0N

Longitude: 123:43:54.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
98	62	38	0	100	100

Note: Mean percent conifer and hardwood for the entire reach are means of canopy components from units with canopy values greater than zero.

Open units represent habitat units with zero canopy cover.

Table 8 - Fish Habitat Inventory Data Summary

Stream Name: 1237318392991 LLID: 1237318392991 Drainage: Big River
 Survey Dates: 5/14/2012 to 5/15/2012 Survey Length (ft.): 2835 Main Channel (ft.): 2805 Side Channel (ft.): 30
 Confluence Location: Quad: MATHISON PEAK Legal Description: T17NR17WS26 Latitude: 39:17:57.0N Longitude: 123:43:54.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: E4	Canopy Density (%): 98.4	Pools by Stream Length (%): 19.9
Reach Length (ft.): 1163	Coniferous Component (%): 74.8	Pool Frequency (%): 31.5
Riffle/Flatwater Mean Width (ft.): 4.5	Hardwood Component (%): 25.2	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 94
Range (ft.): 5 to 9	Vegetative Cover (%): 100.0	2 to 2.9 Feet Deep: 0
Mean (ft.): 7	Dominant Shelter: Undercut Banks	3 to 3.9 Feet Deep: 6
Std. Dev.: 1	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.6	Occurrence of LWD (%): 15	Mean Max Residual Pool Depth (ft.): 1.3
Water (F): 51 - 52 Air (F): 57 - 63	LWD per 100 ft.:	Mean Pool Shelter Rating: 13
Dry Channel (ft): 0	Riffles: 1	
	Pools: 7	
	Flat: 3	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 6 Gravel: 94 Sm Cobble: 0 Lg Cobble: 0 Boulder: 0 Bedrock: 0		
Embeddedness Values (%): 1. 11.8 2. 47.1 3. 41.2 4. 0.0 5. 0.0		

STREAM REACH: 2

Channel Type: A4	Canopy Density (%): 98.0	Pools by Stream Length (%): 22.4
Reach Length (ft.): 1642	Coniferous Component (%): 55.4	Pool Frequency (%): 40.2
Riffle/Flatwater Mean Width (ft.): 3.8	Hardwood Component (%): 44.6	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 100
Range (ft.): 6 to 10	Vegetative Cover (%): 99.4	2 to 2.9 Feet Deep: 0
Mean (ft.): 8	Dominant Shelter: Large Woody Debris	3 to 3.9 Feet Deep: 0
Std. Dev.: 1	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.6	Occurrence of LWD (%): 21	Mean Max Residual Pool Depth (ft.): 1.3
Water (F): 51 - 52 Air (F): 56 - 66	LWD per 100 ft.:	Mean Pool Shelter Rating: 11
Dry Channel (ft): 0	Riffles: 8	
	Pools: 12	
	Flat: 5	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 27 Gravel: 70 Sm Cobble: 0 Lg Cobble: 3 Boulder: 0 Bedrock: 0		
Embeddedness Values (%): 1. 0.0 2. 24.2 3. 36.4 4. 36.4 5. 3.0		

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: 1237318392991

LLID: 1237318392991

Drainage: Big River

Survey Dates: 5/14/2012 to 5/15/2012

Confluence Location: Quad: MATHISON PEAK

Legal Description: T17NR17WS26

Latitude: 39:17:57.0N

Longitude: 123:43:54.0W

Mean Percentage of Dominant Stream Bank Substrate

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Bedrock	0	0	0.0
Boulder	0	0	0.0
Cobble / Gravel	0	2	1.5
Sand / Silt / Clay	66	64	98.5

Mean Percentage of Dominant Stream Bank Vegetation

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Grass	0	0	0.0
Brush	22	23	34.1
Hardwood Trees	10	11	15.9
Coniferous Trees	34	32	50.0
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values:

3

Table 10 - Mean Percent of Shelter Cover Types For Entire Stream

StreamName: 1237318392991

LLID: 1237318392991

Drainage: Big River

Survey Dates: 5/14/2012 to 5/15/2012

Confluence Location: Quad: MATHISON PEAK

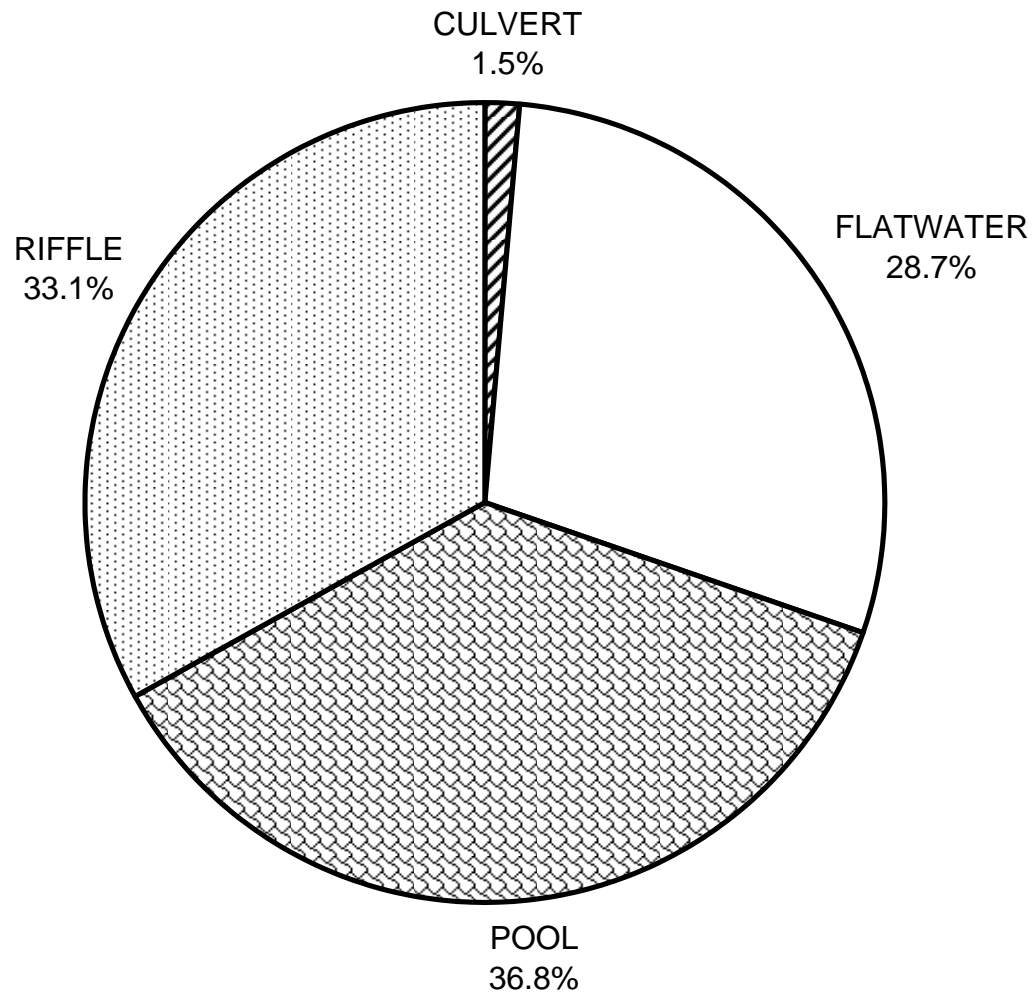
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Longitude: 123:43:54.0W

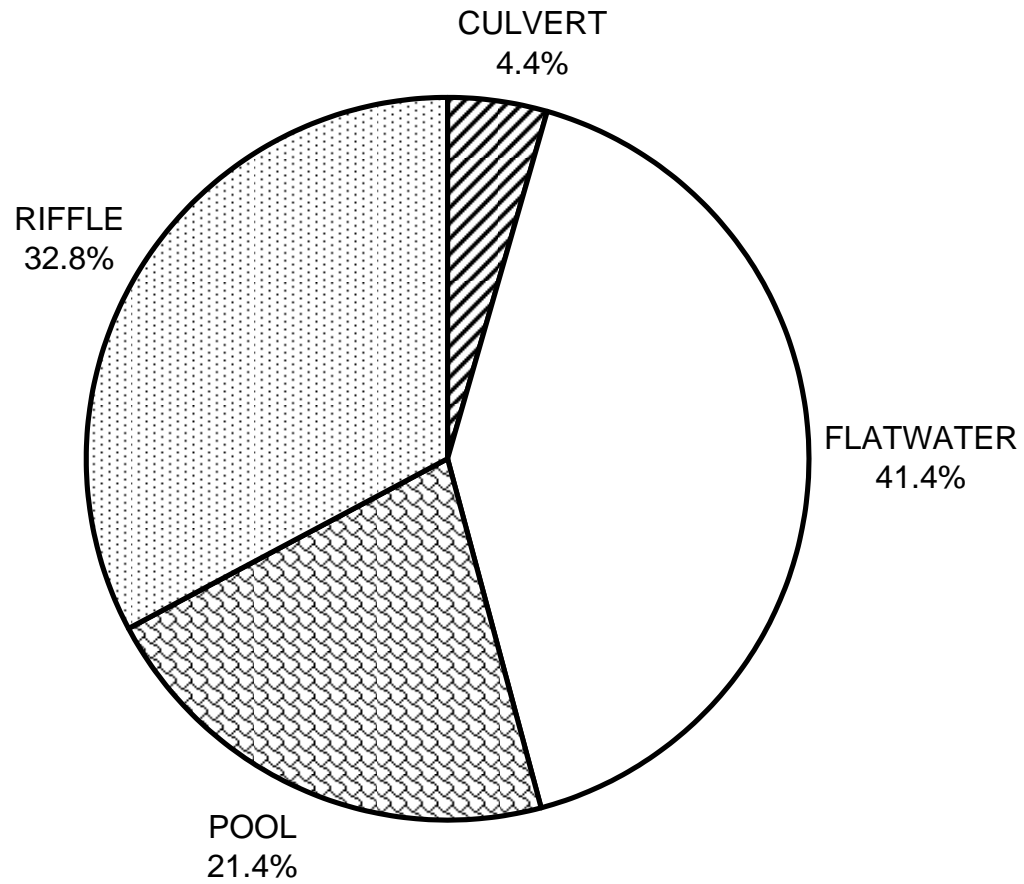
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	0	32
SMALL WOODY DEBRIS (%)	0	80	25
LARGE WOODY DEBRIS (%)	0	20	28
ROOT MASS (%)	0	0	1
TERRESTRIAL VEGETATION (%)	0	0	0
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	13
BOULDERS (%)	0	0	1
BEDROCK LEDGES (%)	0	0	0

"NELSON GULCH" 2012 HABITAT TYPES BY PERCENT OCCURRENCE



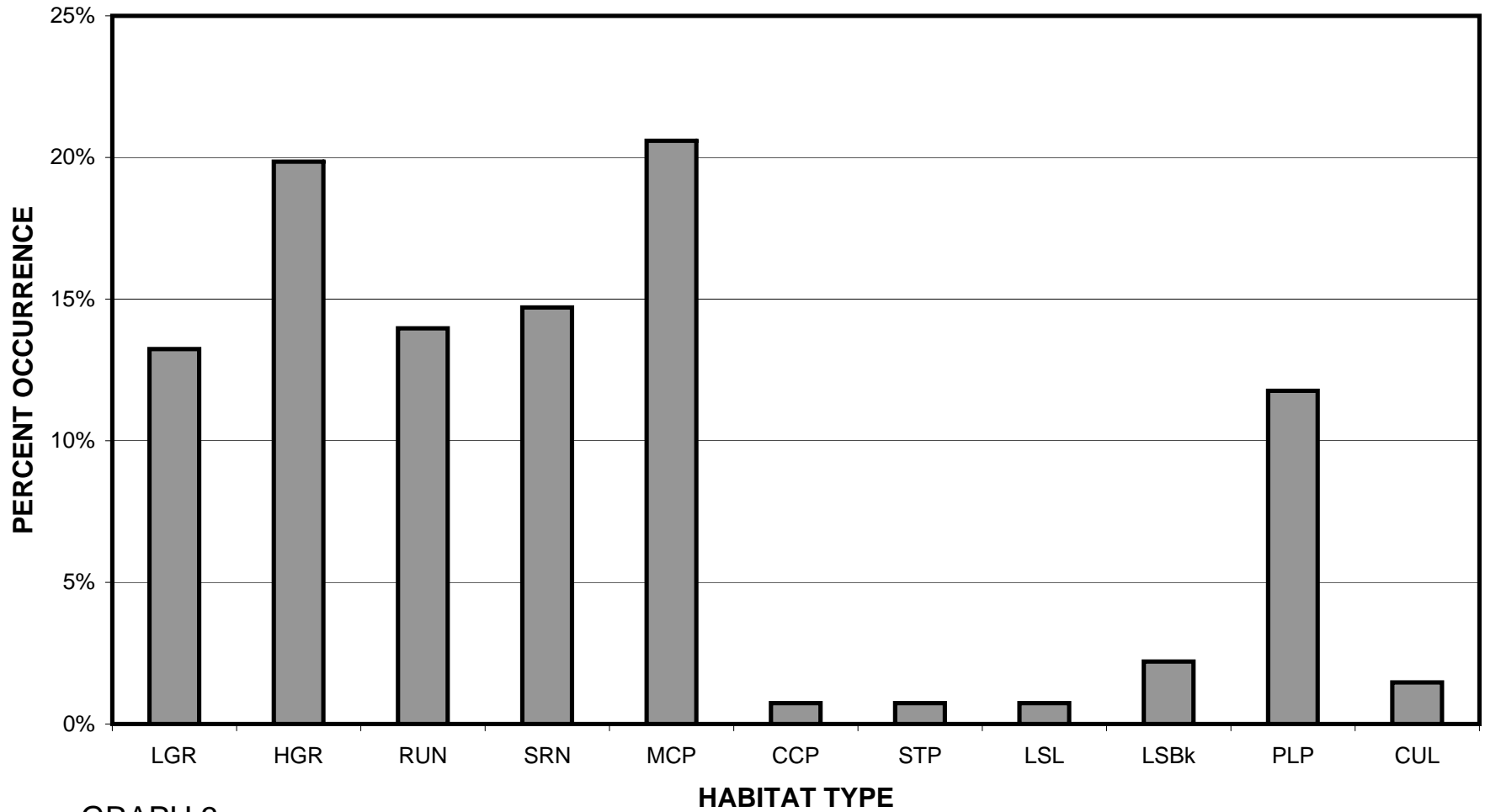
GRAPH 1

"NELSON GULCH" 2012 HABITAT TYPES BY PERCENT TOTAL LENGTH



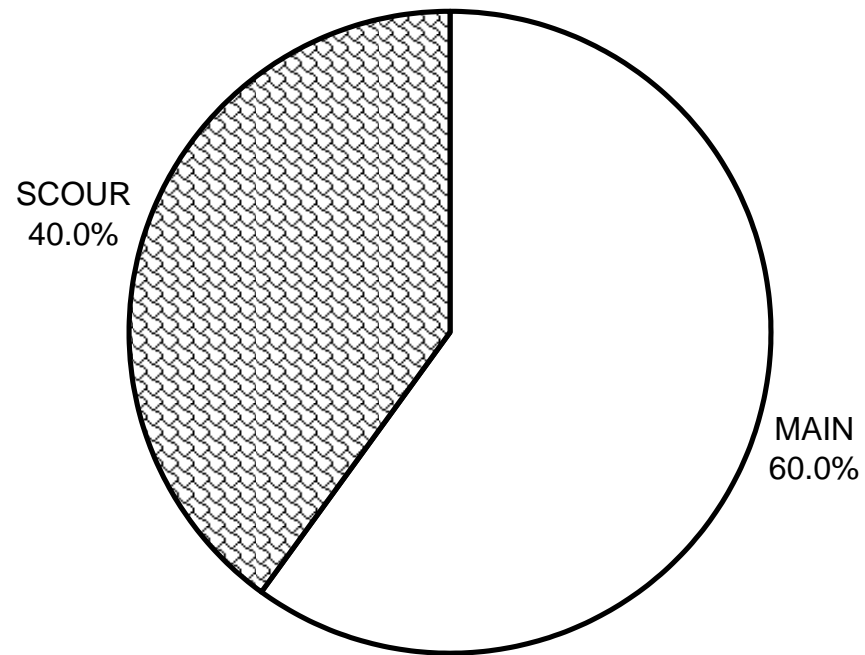
GRAPH 2

"NELSON GULCH" 2012 HABITAT TYPES BY PERCENT OCCURRENCE



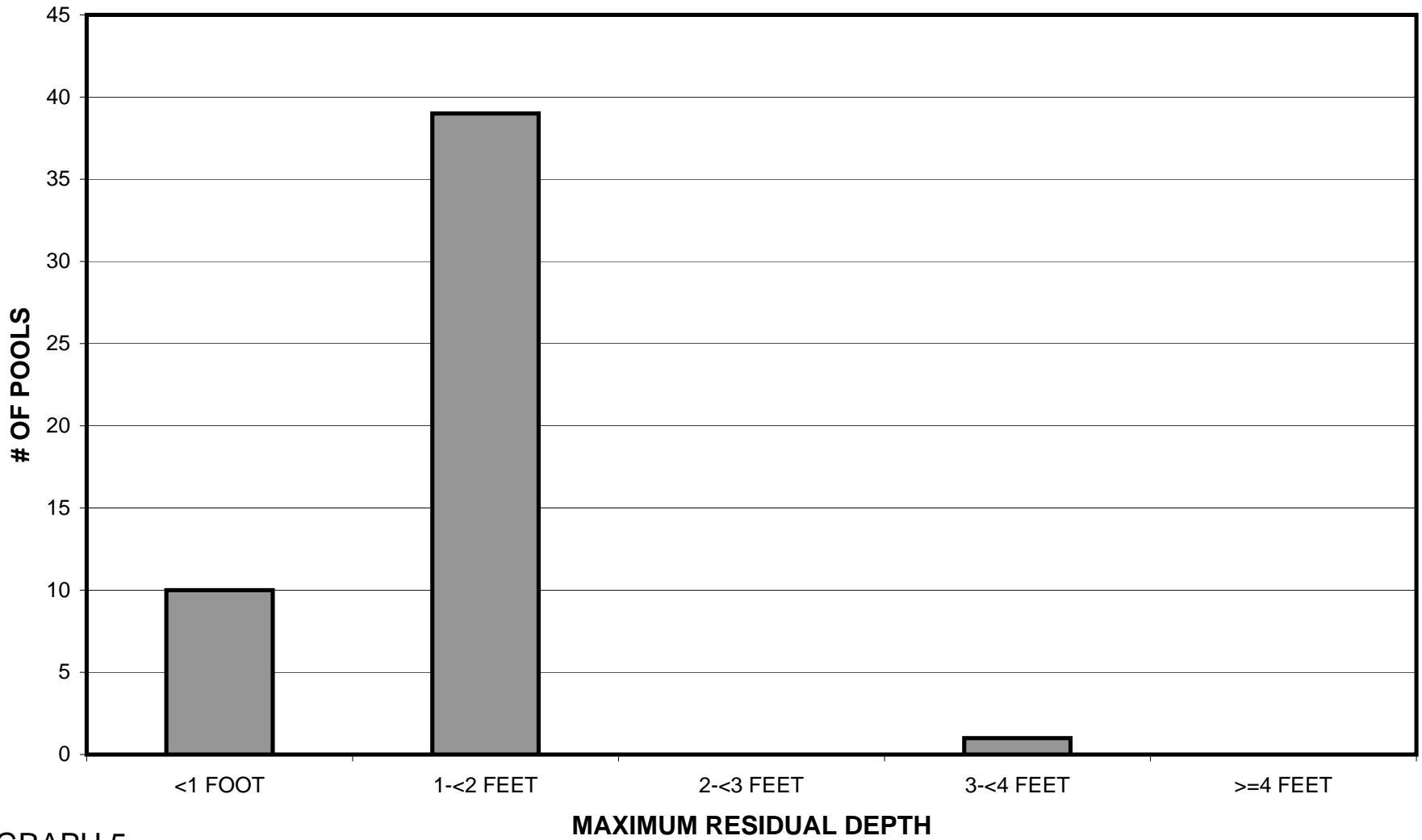
GRAPH 3

**"NELSON GULCH" 2012
POOL TYPES BY PERCENT OCCURRENCE**



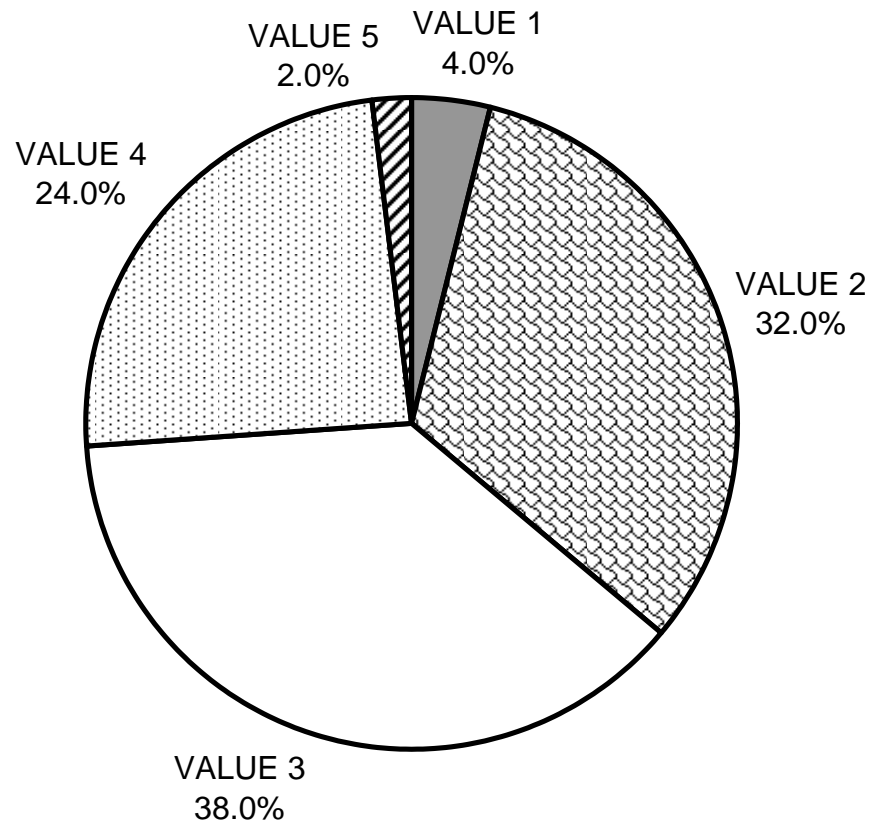
GRAPH 4

"NELSON GULCH" 2012 MAXIMUM DEPTH IN POOLS



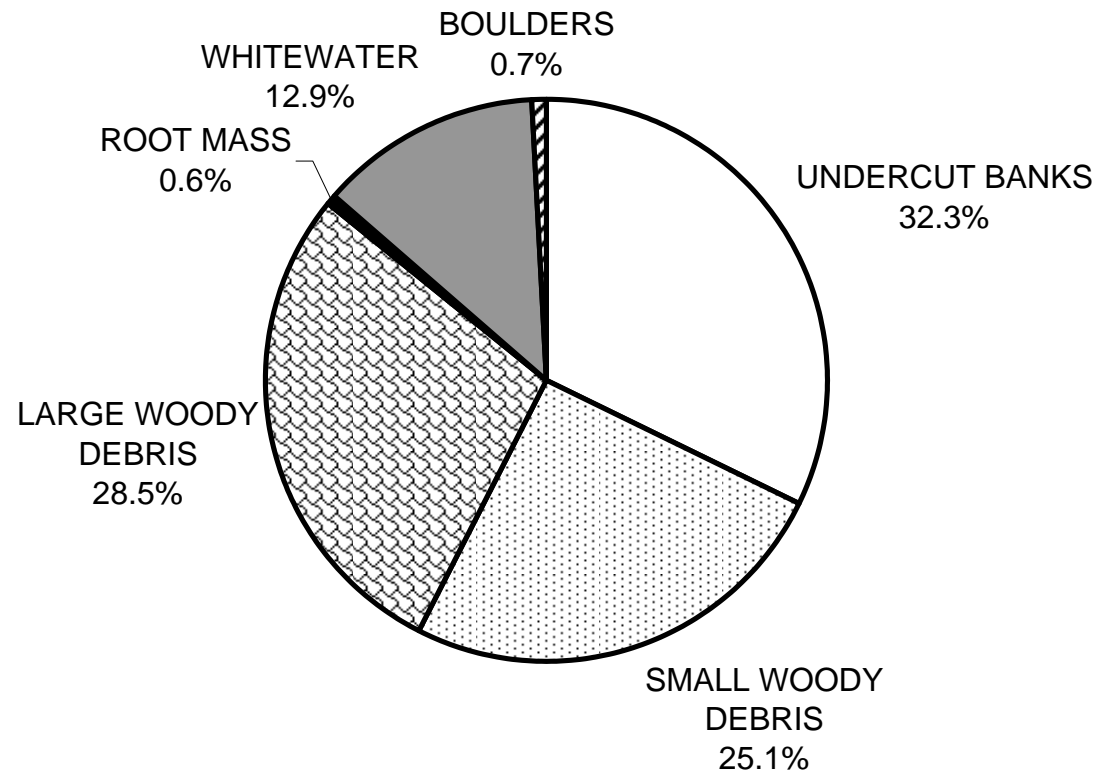
GRAPH 5

"NELSON GULCH" 2012 PERCENT EMBEDDEDNESS



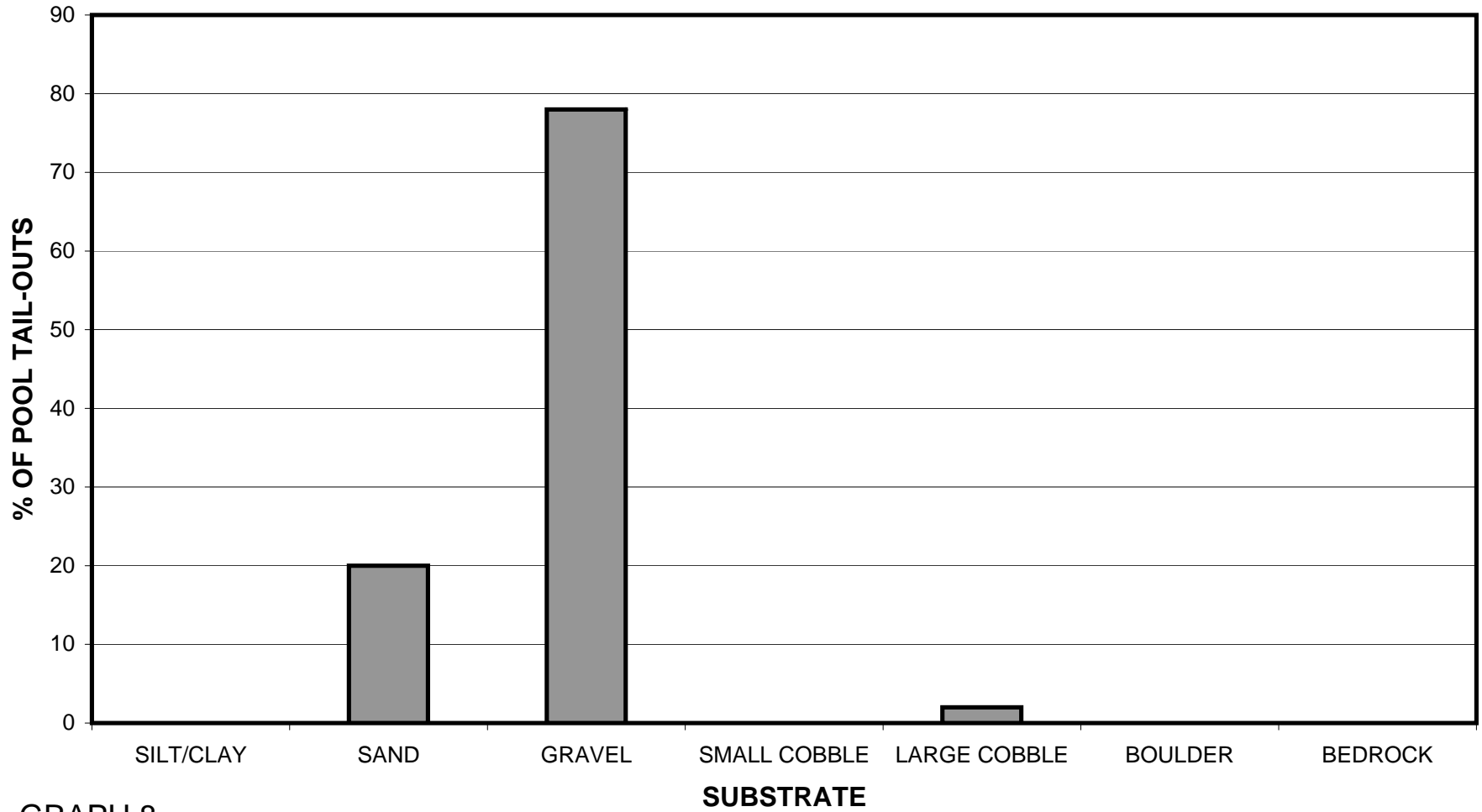
GRAPH 6

"NELSON GULCH" 2012 MEAN PERCENT COVER TYPES IN POOLS



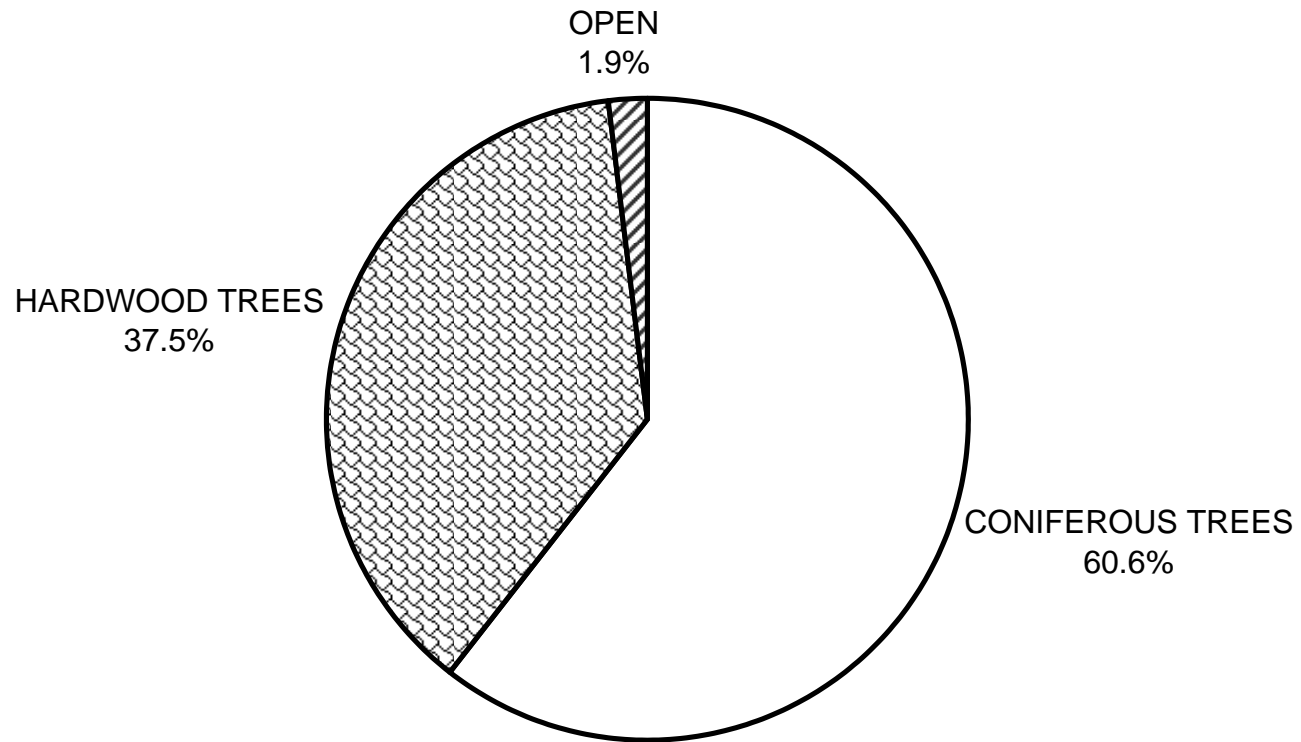
GRAPH 7

"NELSON GULCH" 2012 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



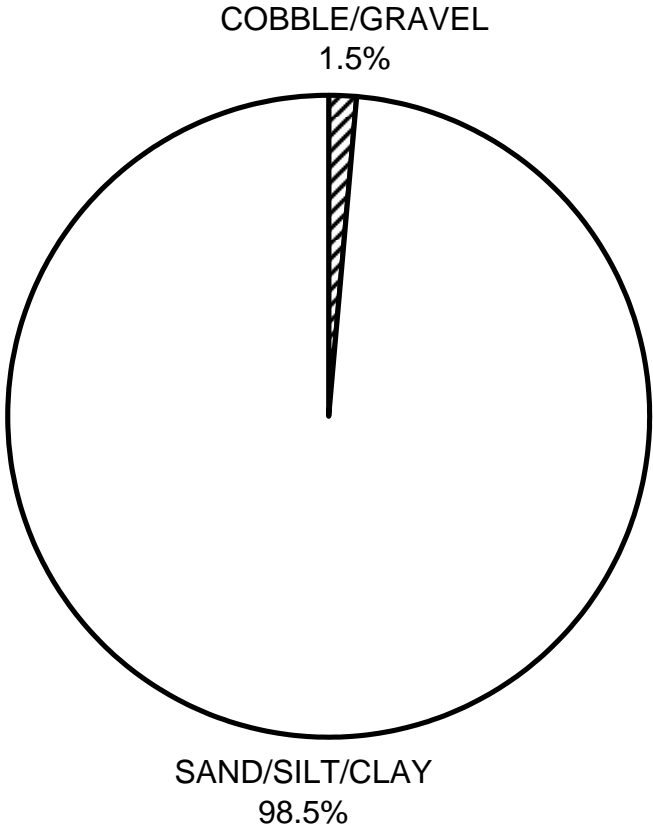
GRAPH 8

"NELSON GULCH" 2012 MEAN PERCENT CANOPY



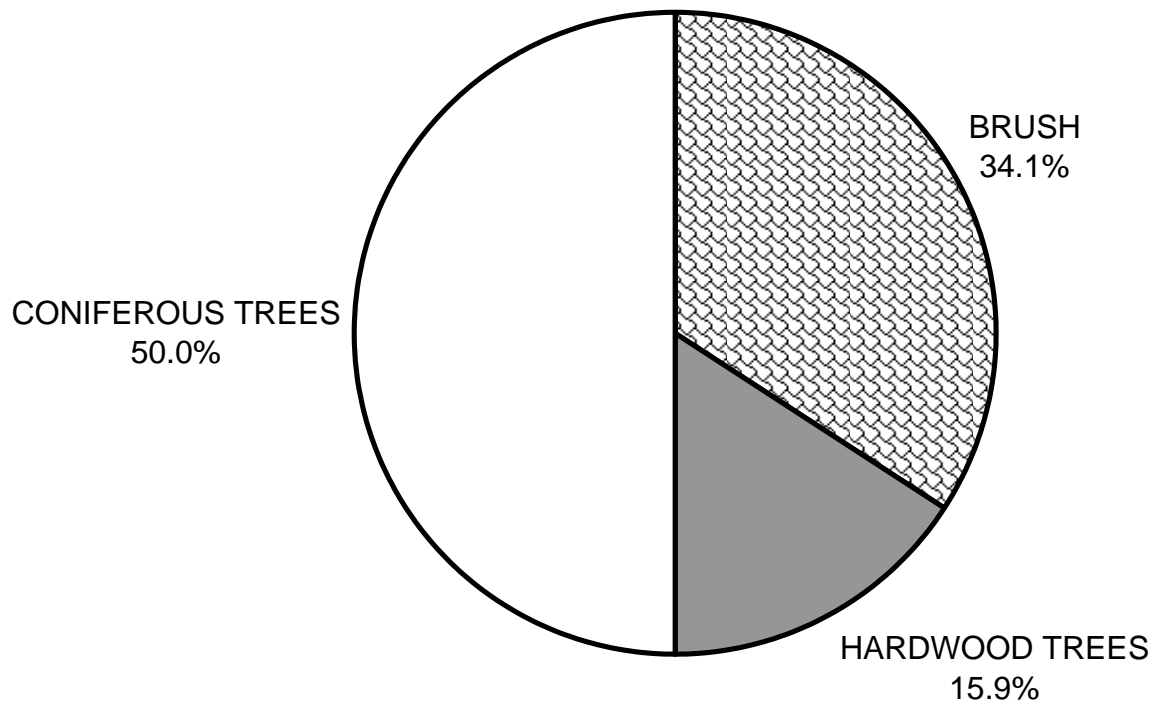
GRAPH 9

**"NELSON GULCH" 2012
DOMINANT BANK COMPOSITION IN SURVEY REACH**



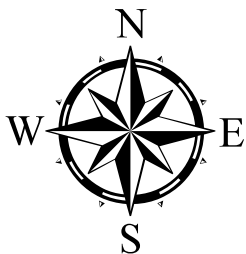
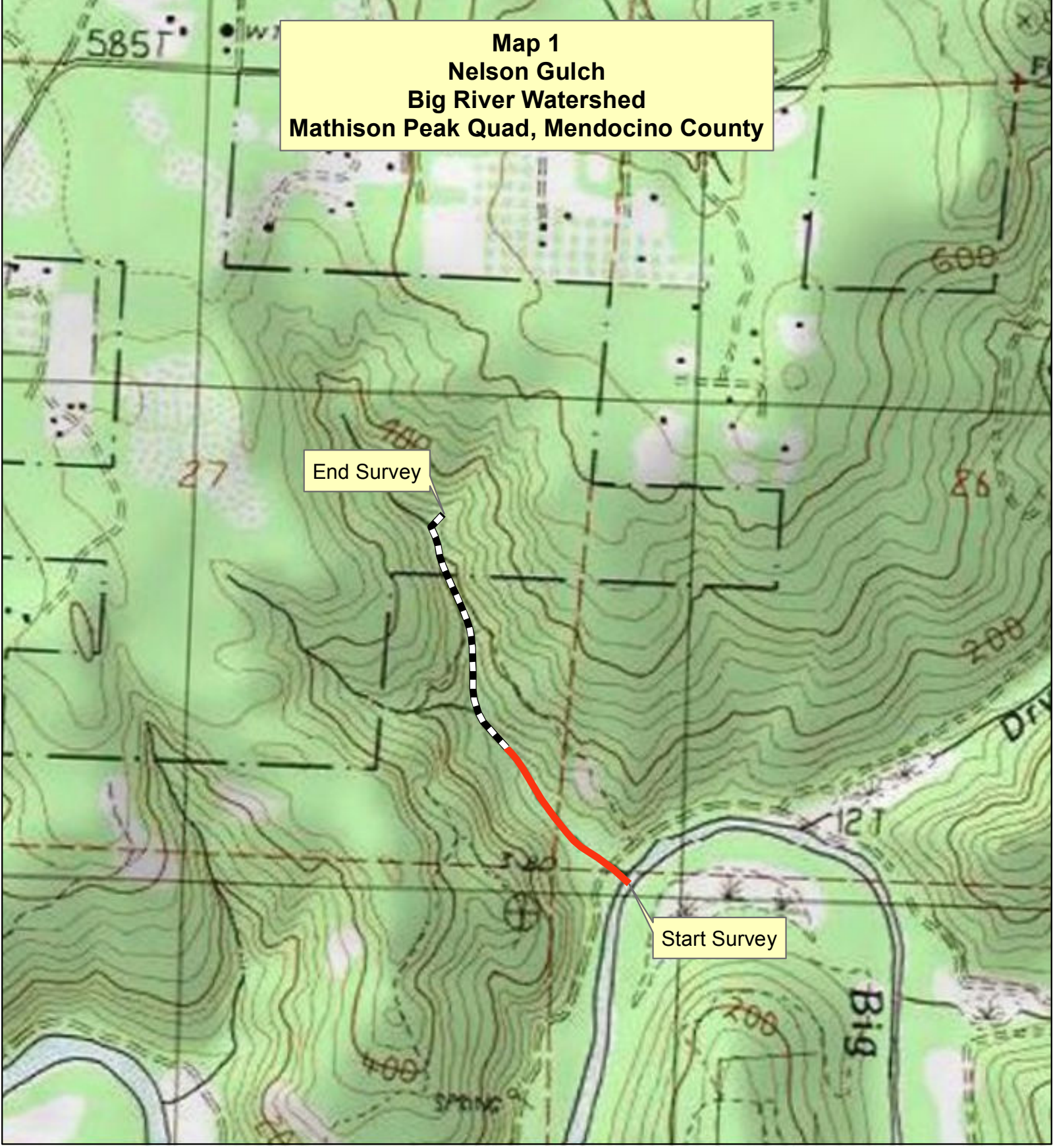
GRAPH 10

**"NELSON GULCH" 2012
DOMINANT BANK VEGETATION IN SURVEY REACH**



GRAPH 11

**Map 1
Nelson Gulch
Big River Watershed
Mathison Peak Quad, Mendocino County**



- Reach 1, Channel Type E4
- - - Reach 2, Channel Type A4

